

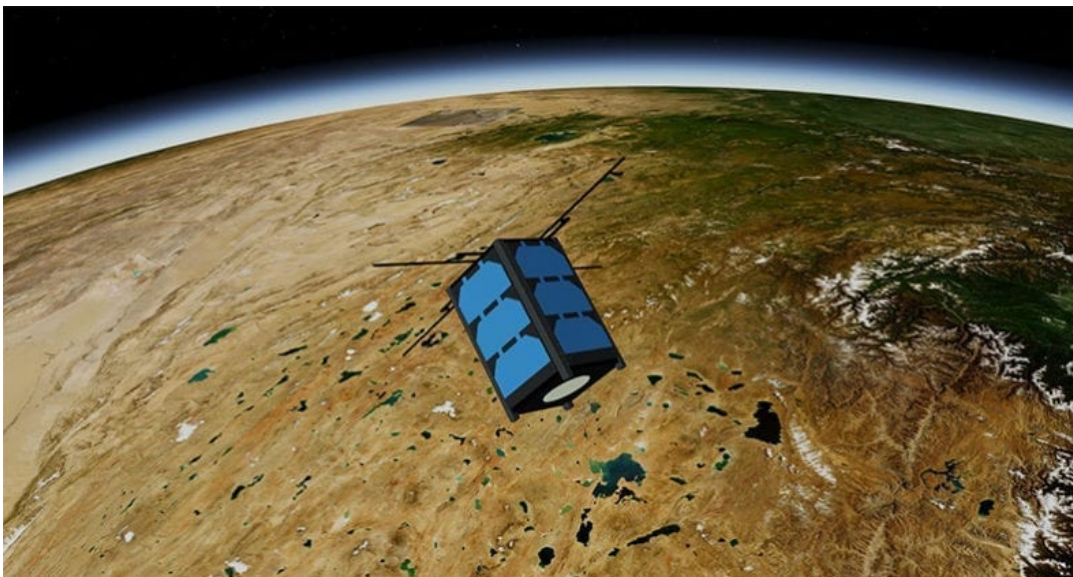
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# Space exploration that fits in your pocket

## NEWS STORY

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Curtin has built its very own miniature satellite, helping to boost Australia's position as a contender in the new space race.



This year marks the 50th anniversary of humans landing on the Moon. While the US laid claim to imparting the first footprints on its dusty surface, it was thanks to [Australian technology](https://www.sbs.com.au/news/the-moon-landing-50-years-ago-might-not-have-been-seen-without-these-australians) (<https://www.sbs.com.au/news/the-moon-landing-50-years-ago-might-not-have-been-seen-without-these-australians>) that the world was able to witness the seminal event.

Fifty years on, Australia still plays a pivotal role in space exploration and aims to one day send its own missions to the Moon and beyond.

Leading this ambition is Curtin University's [Space Science and Technology Centre](https://sstc.curtin.edu.au/) (<https://sstc.curtin.edu.au/>) (SSTC), which has built its first 'pocket-sized' satellite, known as a CubeSat.

**"CubeSats are the latest generation in satellite technology. They're much smaller than any other satellite that has gone before," says Curtin Distinguished Professor Phil Bland, Director of the SSTC.**

"The Curtin team has managed to put in all the systems required to operate the satellite, including the power, computer, steering and communications, on a single eight-layer printed circuit board. At 10cm by 10cm by 2.5cm, it's about the size of a rather small sandwich."

Given that space is quite big, what are the benefits of launching a snack-sized satellite into its boundless expanse? Ben Hartig, one of 12 Curtin engineers involved in the project, says cost is a significant factor.

“A typical CubeSat weighs one to three kilograms, whereas a traditional satellite can weigh up to around seven tonnes, and the price to launch varies with mass.

“Large satellites can run into the billions of dollars for a launch. The most expensive CubeSat launches are under half a million. However, ours is significantly less than that as it is small, even compared to the majority of CubeSats.”

Another advantage of its miniature size means the CubeSat can hitch a ride on a rocket with a larger satellite – in this case, a re-supply rocket headed for the International Space Station (ISS) in 2020. The SSTC has partnered with the European Space Agency, which will provide mission control for the CubeSat’s launch from the ISS into low Earth orbit.



The mini sat will be launched into orbit from a resupply rocket headed to the ISS.  
Credit: NASA.

From its lofty heights, the CubeSat will spend 400 days circling Earth and taking photos of Australia, allowing us to see our home from a whole new perspective.

But perhaps the best thing about the satellite is it’s giving young engineers hands-on experience in spacecraft construction and mission control.

“Having the opportunity to work on ‘space stuff’ and small spacecraft right here in WA is quite amazing,” says Daniel Busan, a 2017 Curtin mechatronic engineering graduate.

“I have been involved with the CubeSat project since early 2018. Alongside making orders for assembling and manufacturing circuit boards and prototype systems, I’m working on creating our own in-house communications solution for the CubeSat bus.”



Before the CubeSat can embark on its 2020 mission, it will undergo rigorous testing on the ground at Curtin, followed by a sub-orbital launch from the US later this year.

“The sub-orbital launch provides a great opportunity to test the satellite’s ability to survive a launch, as well as its attitude control and location determination systems, which we have designed in-house,” explains Hartig.

“These systems track where the satellite is, how fast it’s moving and which way it’s facing. The launch also gives us a brief zero-gravity window to test them.”



The CubeSat team with Professor Phil Bland (third from right) and Curtin Pro-Vice Chancellor, Deb Terry (far right).

The team have set up specialised equipment at the University to determine how well the CubeSat can withstand the conditions of space in low Earth orbit, such as extreme hot and cold temperatures, being in a vacuum and exposure to low radiation.

**“Back in the lab we test the satellite by putting it in as similar conditions as we can using vacuum chambers, heating elements, liquid nitrogen and vibration machines,” explains Hartig.**

“Our engineers have even designed a [Helmholtz coil \(https://www.comsol.com/model/magnetic-field-of-a-helmholtz-coil-15\)](https://www.comsol.com/model/magnetic-field-of-a-helmholtz-coil-15) apparatus that allows us to simulate the changes in the Earth’s magnetic field that the CubeSat will experience.”

The CubeSat will help contribute to the Australian government’s larger mission to boost the nation’s space industry, which includes sending Australian astronauts to the Moon.

“The Moon is intimately involved in the story of our planet’s evolution, and understanding its geology and formation informs us about our own history and our part in the story of the Solar System,” says Hartig.

“However, as an engineer, I spend most of my time thinking about the ‘how’ rather than the ‘why’.

**“How can we get to the Moon, how can we analyse it and how can we survive there?”**

The CubeSat will not only help to answer these questions, but will further the development of ‘mini-sat’ technology and their ability to explore deep space.

Sadly, its mission is one-way. After spending more than a year in orbit, it will succumb to the pull of the Earth’s atmosphere.

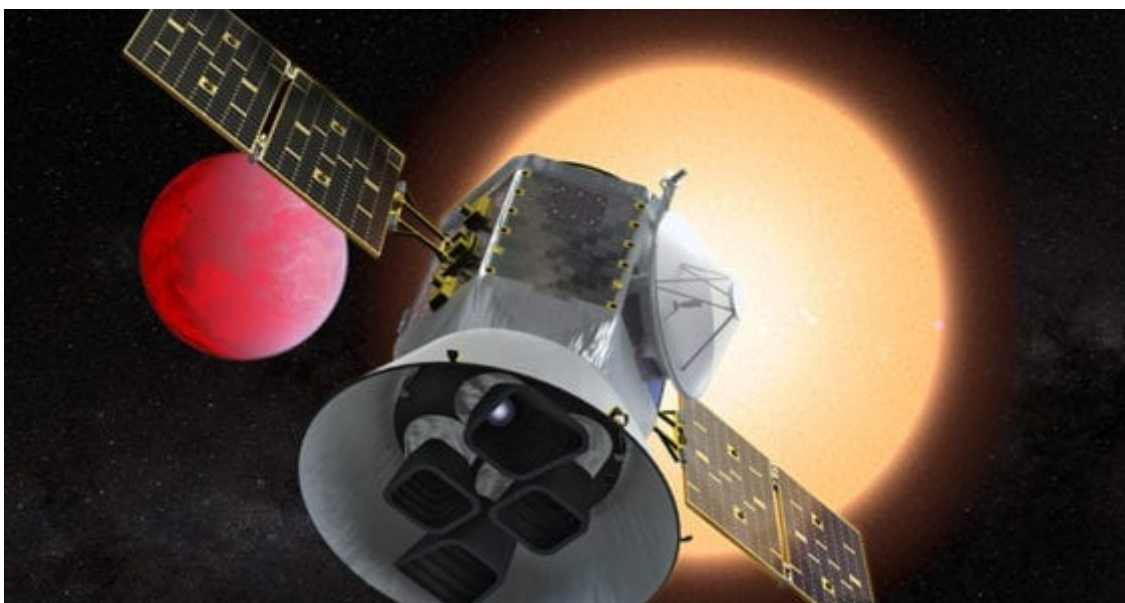
“Our CubeSat will never make it back to Earth,” says Hartig. “It will instead completely burn up from the friction of the air as it races towards the ground.”

But thanks to the little sat that could, we may soon see an Australian satellite landing on the moon, or even a new set of footprints on other planetary bodies.

#### Did you know?

- CubeSats were first developed in the late 1990s by California Polytechnic State University to give engineering students experience in satellite design and development.
- Between 1998 to 2018, more than 1,000 CubeSats have been launched into space.
- The CubeSat that has explored the furthest reaches of space is NASA’s EVE. In 2018, EVE was recorded being 3.2 million kilometres past Mars after completing its role in NASA’s [Mars InSight mission](https://mars.nasa.gov/insight/) (<https://mars.nasa.gov/insight/>).
- Curtin planetary scientist Dr Katarina Miljkovic is involved in the InSight Mission, studying the crust and interior of the Red Planet.

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